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The television camera is a means of extending the number of students per teacher, and it is an invaluable visual asset. It relies on visual aids produced by the instructor, and can easily be mounted on a demonstration table with proper equipment and a small monitor. Although the instructor cannot display much material simultaneously with the camera, he has easy access by facing the class, and immediate erasures are possible. Other advantages are that graphic materials can be used without special preparation, the instructor can have all shades of black, white and gray on the same paper, and there is no keystone distortion. In comparison to a transparent slide projector, the overhead television's greatest limitation is the smaller screen. However, material can be changed quickly by zooming the lens out or in. The advantages against the film strip projector are the same as with the slide projector. The overhead television is compared with the opaque projector, and the conventional television. A major advantage is the allowance for more emphasis on certain subjects. Feasibility of the overhead television is also discussed, showing prices for maintenance and usage as compared with other audio-visual assets. The kinds of cameras and lenses, as well as circuits, are also briefly discussed. A drawing of the position of an overhead television in a laboratory is given.

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INSTRUCTIONAL TECHNOLOGY - U.S.C.

OVERHEAD TV - THE IDEAL VISUAL AID

by Rudy Bretz
UCLA

The television camera has held great promise in education as a means of extending the teacher-student ratio. The possibilities of visual presentation of lecture material have been well explored, and full exploitation of these opportunities in television teaching has resulted in improved instruction. In certain instances a closed circuit television system has been used entirely within the classroom or auditorium, the so called "classroom magnifier" application. In such cases television is being used simply as a visual aid. Its use has been primarily concerned with small demonstrations which could not otherwise be made visible to the entire class. This article describes a further application of the television camera which allows it to provide the same aids to teaching as the usual classroom projectors and other devices. The camera is mounted over the teacher's head and shoots straight down onto the table or podium in front of him. The effectiveness of this "Overhead TV" method is attested to by its first user, Maryo Van Deman, acting assistant professor of music who has been using Overhead TV in teaching a basic course in music for classroom teachers at the University of California, Los Angeles.

"This teaching tool has proved so highly effective that after half a semester of teaching with it, I was able to give the students the usual final examination at midterm."

Our experience indicates that a TV camera used overhead on visuals can be more effective in many respects than each of the more familiar visual aid devices. It also appears that one Overhead camera can combine the major functions of all of the most commonly used visual aids except film. This does

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not imply that wide use of Overhead TV will make all other visual aids obsolete, since each device has a place, even though the major determinant may be only economic. It does mean, however, that the well-equipped classroom could be provided with Overhead TV to the exclusion of the usual complement of visual devices, (except films and possibly filmstrips) with a resulting improvement in the ease, effectiveness and simplicity of visual teaching.

"Overhead Television" strongly favors the visual aids which are produced by the instructor himself, rather than the prepared visuals supplied from a central producer or agency. A disadvantage is that existing libraries of slides are not readily useable.[1] However, a wide variety of readily available visual material can be used instead, which in most areas greatly exceeds the amount of materials available in slide libraries. I am referring to illustrations in books and periodicals, snap shots, drawings and sketches, maps, and all such material which the instructor has within arm's reach on his desk or in his files. The things you are acquainted with and have on hand are useable, when your visual device is the Overhead TV camera. Any size of material from 2 3/4 inches to 12 inches in width can be made to fill the TV screen, or the camera can zoom in and out on one graphic between these extremes. But let us look at the device and the technique.

A small TV camera with zoom lens is mounted on a copying stand, which is then placed on the demonstration table; or on a floor stand with an arm holding the camera overhead. Figures 1 and 2 illustrate these two applications. Obviously the floor stand and arm method is to be preferred, since the teacher can look directly forward at the class without any apparatus in the way. A device with a counter weighted arm, as shown in figure 3, will allow the camera to be placed in a variety of positions for optimum viewing of science demonstrations and the like.

A small monitor is necessary so the teacher may see what he is showing

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[1]The writer has designed a device which will permit the simple integration of slide or filmstrip projectors with the demonstration stand portion of this equipment. Existing slides can thus be mixed with the other effects listed below.

with the camera. The best position for this monitor is directly in front of the teacher, either in the front row of the class, or on the floor so he may watch it by looking over the demonstration stand.

To substantiate the thesis of this article, which is that television, used in this particular way, is superior in most respects to the standard visual aids, let us analyze each in turn and compare its effectiveness with that of Overhead TV

Overhead TV As Compared With the Chalkboard

The instructor can write or draw as he talks, he can erase and write again in the same place, and as with specially prepared chalkboard drawings, he can follow prepared lines in drawing a difficult diagram.

He is limited, in comparison with the chalkboard, in not being able to display as much material simultaneously, and not being able to use colors.

However, he has many advantages over the chalkboard. He can continue to face the class while writing. He can have immediate "erasure" by simply removing the written material from the view of the camera, and he can have immediate reprise of this "erased" material. The fact that writing and drawing for the Overhead TV camera calls for writing in normal handwriting size may result in more intimate contact, faster writing, or possibly more ease in writing while talking. He has a further advantage of being able to prepare drawings at leisure, without prior access to the classroom. The fact that the TV camera is showing only a limited area at a time has the function of emphasizing the material under discussion while at the same time eliminating material which is not germane and is often distracting when left on a chalkboard in view of the class. The line of sight is never blocked by the teacher or other objects. A unique feature is the possibility of zooming in for a close-up of a portion of a drawing or zooming wide for orientation. Finally, all these features may be combined with the use of graphics and objects, one can use manipulative techniques associated with the flannel board and magnet board.

use simple puppets and so forth.

Overhead TV As Compared With the Overhead Transparency Projector

The TV camera in this application bears the following similarities to the overhead projector. The instructor can face the class while talking; he can operate the device himself at the front of the room; the room need not be darkened; and he can write or drew while talking. He can use still pictures and all manner of graphic methods, including semi-animation techniques involving transparent or opaque layovers. He can use pre-lined materials of various sorts.

The Overhead TV camera is limited to a smaller screen and the use of black and white materials.

The TV camera has the following advantages: still pictures and other graphic materials can be used directly without the need of special preparation of acetates. The instructor can write or draw in all the tones of black, white, and gray on the same drawing; he is not limited to only white or only black. Keystone distortion, often noticeable in overhead projection is not a problem on the TV screen. Objects may be displayed, not only in silhouette as in the case of the overhead projector, but well-lighted and from any angle as they are placed and turned beneath the camera. Again, the zoom lens feature is unique, allowing for wide-shot orientation and close-up analysis of detail. This same feature makes it possible to use original materials of many different sizes in combination.

Overhead TV As Compared With the Transparent Slide Projector

The Overhead camera is similar as a visual aid in that it allows for the display of still pictures, maps, charts, graphs and other graphics including those prepared by the teacher.

Again, the limitations are first, a smaller screen, and second, the lack of color. A third limitation could be listed: libraries of slides exist which could not be used on the Overhead camera except as incicated in footnote 1.

The main advantage is in the use of original art work, photos, illustrations, pages from a book, etc., without the time, trouble, and expense of preparing transparent slides.

The instructor can point to a portion of a graphic, add cut-out figures, draw on the graphic and so forth. He can use transparent or opaque layovers. He can selectively reveal portions of a graphic, either by moving it, zooming the lens out, or by sliding off covering shutters. He can "pan," "tilt", or move diagonally across a large graphic (by sliding the graphic under the camera). A projectionist is not needed, and the instructor, operating his own machine, can be at the front of the room facing the class. The room need not be darkened. The instructor can widen and narrow the field of view and can incorporate the use of objects, manipulations, and other visual materials.

Overhead TV As Compared With the Filmstrip Projector

The comparative advantages of Overhead TV vs the filmstrip projector are the same as those listed above for the slide projector, except for one additional factor. One of the big advantages of the filmstrip is that the pictures are in a fixed order. Few filmstrips are specially prepared by the teacher for his own use; most filmstrips are produced for wide use and distributed on a nation-wide basis. The filmstrip projector, like the film projector, has a place of its own which Overhead TV is not likely to greatly affect. (Footnote 1 suggests integration of the filmstrip projector into Overhead TV.)

Overhead TV As Compared With the Opaque Projector

The TV camera is similar in that still pictures may be used; pages from books or other published materials may be used directly. The instructor can point to things in these materials. The limitations are as before: small screen and lack of color.

Among the advantages are the fact that the instructor can keep the room

lights on. He can use materials which are not strictly flat, such as open books, objects, etc., and bring these into sharp over-all focus. He will not need a projectionist, sometimes necessary with opaque projection. He can write on the materials, use cut-outs, shutters, layovers, etc. Finally he can zoom in and out.

It is clear by now that the Overhead TV method is capable of the same uses as the flannel board and magnet board, minus the mechanical problem of fighting gravity. The hazards and irritations due to "fall-off"--especially with the flannel board-- are eliminated. You simply place and manipulate the figures on a horizontal plane in front of you. Flannel board techniques may thus be combined with writing, drawing, display of objects, etc. The problem of large scale construction is eliminated; the working area may be 12 inches wide or less if desired.

Flash cards, display graphics and other devices usually held up before the class can now be used on Overhead TV with the advantages of greater visibility, zooming in for close-ups, and integration with other visual devices and techniques. Costly and elaborate models built in large scale so they can be seen from the back of a classroom can now be eliminated. Blackboard compasses, protractors, etc. can be the same size instruments the students are also using. The slide rule, the micrometer, etc. may be taught from a slide rule or micrometer of standard size.

Overhead TV As Compared With Conventional TV Camera Positions

The conventional TV camera position involves the camera mounted on a tripod in front of the lecturer with visuals displayed on easels, either of the floor or table type. It will also be used on graphics held in the hand and on objects displayed in the hand or on the table top.

Placing the camera in the overhead position limits it to visuals and table top demonstrations. It cannot normally be used to transmit the image of the teacher or other areas in the room.

However, the Overhead camera position has the following advantages: The instructor can write or draw on a small area, something which is very difficult to accomplish when the work is held vertically on an easel. The instructor can operate the camera himself without special skills, no cameraman is needed and there are no coordination problems. Since materials are laid horizontally, gravity will hold them in place, and cut-outs, layovers, etc., are easy to manipulate. Materials will stay in any position. The instructor can "pan" or "tilt" by sliding the graphic across the camera field. This cannot be done on an easel without great difficulty.

In the listings above the disadvantages of Overhead TV included two factors in nearly every case: small screen and lack of color.

A screen, of course, is only large or small in relation to its distance from the viewer. A reader holds an illustration which is six inches wide, a foot from his face. The image of this picture fills the same area of his retina as the image of a screen 25 feet wide when he sits in an auditorium 50 feet from the screen. As far as his eye is concerned, the 6 inch picture in one instance is exactly as large as the 25 foot screen in the other.

If TV screens are not manufactured in a sufficiently large size then more than one screen should be used. The limitation is really economic, in that we are trying to serve more viewers than we should with a screen two feet wide. Nevertheless, certain production techniques have been developed to cope with the small screen problem and these are in themselves valuable teaching devices. I refer, in this case, to the technique of zooming.

Emphasis on a portion of a display can best be provided by enlarging that portion and eliminating all the rest. Possible distractions from no-longer-applicable areas are eliminated. This lends itself directly to learning in the "gestalt". The instructor shows a wide area, zooming in to a close-up of a small section to analyze detail, then back to the wide shot to show relationships again. It is a good answer

to the problem of the small screen. If the TV screen were twice or four times as wide, zooming in and out would be only half or one quarter as necessary. But emphasis would have to be achieved by other means. Covering up parts of the display and revealing them only when appropriate is one possibility. Vignetting, spot lighting, etc., might also be employed, but it is my guess that in and out camera movement will still be the preferred method, providing wider wide-shots and closer close-ups. There is no possible doubt that when wider TV screens are feasible, they will be adopted for the classroom. The small screen is a limitation, but a temporary one, and small indeed in comparison to the many advantages of Overhead TV.

The second disadvantage is the absence of color. This again, is temporary. Color is available for the classroom today, but it is not good, not reliable, and not economically feasible. It is a matter of time, and possibly also of demand, before closed circuit color TV can be considered an available teaching aid.

A word should be added about reliability. About all that can go wrong with a slide or opaque projector is that a bulb may occasionally burn out. Those of us who have had experience with complex electronic equipment like TV cameras have often been irritated by frequent technical troubles. However, constant improvement and simplification in circuits and operating design is resulting in equipment which is increasingly stable and simple to operate. The writer has used one small TV camera for over two hundred hours without interruption of scheduled service.[2]

Feasibility of Overhead TV

There are many manufacturers making small industrial cameras suitable for overhead use, and the field is expanding constantly. Some of these cameras

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[2]Vertical operation of a TV camera has been discouraged by engineers due to the hazard of falling particles within the tube, damaging the photocathode. Experience has shown tiny white spots showing up after about 100 hours of vertical use. Vidicon tubes of Series 7000 and above are equipped with a screen to catch these particles and can thus be used vertically without danger.

are priced under $600, some over $1,200. Add $400 for a zoom lens, $350 for a good classroom monitor, and perhaps $200 for a small monitor for the instructor. If the stand and various adaptations come to another $200 the total cost will be between $1,750 and $2,350. Ten per cent of this per year would probably cover its maintenance.

Can we afford one in every classroom? Hardly. But when new classrooms are built (average cost: $40,000 per classroom) it might be possible to save five per cent by sacrificing paint or woodwork or something and put the money into better teaching.

By arguing that a TV camera in a classroom (or in a school, since it can be almost as portable as a film projector) replaces the other visual aids, how much could one justify it against possible savings? First we can add up the costs of one slide projector, one overhead, one opaque, one screen, etc. We will not list the chalkboard, as it will still have many purposes beyond its use as a visual aid in presentation. But how about the costs of preparing or purchasing materials for the slide projector and the overhead. This expense can certainly be saved. It is hard, of course, to determine what this might be. The TV camera, being more flexible and convenient, would be used more than the other devices. A comparable amount of visual material would cost considerably above present budgets if it were specially prepared.

Slide projector	$ 100
Screen	50
Opaque projector	300
Overhead projector	350
	$ 800
Maintenance for 5 years at 10 per cent per year	400
Savings in special preparation of slides, transparencies, etc. for 5 years @ 300/year	1500
Total	$2700

	Max.	Min.
TV camera system	$3000	$1150
Classroom monitor	330	330
Teacher's monitor	220	220
Camera, stand, etc.		
Zoom lens	400	400
Total	$4150	$3300
Plus:		
Maintenance over 5 years	1775	1775
Total	$5925	$5075

The difference is $2375 to $3225 which we must justify over five years ($475 to $645 a year) in terms of greater convenience, increased uses, (and thus improved teaching) plus various other uses for the same TV equipment.

Overhead TV may also be used to present a demonstration to several classes at once. This will require transmitting the image of the teacher, as well as his visual aids. We add one camera, and a switch under the control of the teacher. We are adding a viewfinder camera with lens turret, controllable from the rear, and a focusing knob. We now utilize a cameraman (no one else, and we need no control room). The new camera is flexible and can follow the teacher to any part of the room (except against the outside windows). The 7325 Vidicon tube is used and no special lighting is necessary. When the teacher wants to use a visual aid, he goes to the Overhead camera (which, of course, is in full view) and switches at will to the close-up of his visual.

In front of his demonstration table the teacher has his small monitor, on which he watches the picture from the Overhead TV camera. Attached to the mobile viewfinder camera is a small master monitor facing the teacher (see NAEB Journal, May '60). When the teacher wants to address the TV students directly he looks into this camera in front of him. If he has switched it onto the line he will see himself on the monitor next to the camera lens. If he has forgotten to make the switch, the presence of the wrong picture on the monitor will remind him.

Now let us say he is through with graphics, writing of equations and all the sorts of things he can do under the Overhead camera and has to perform a science

experiment on the table top. The best angle from which to show this is a 45 degree angle from above. The manned camera could not easily get into a high enough position. So the teacher reaches up to the Overhead camera, pulls it down on its boom, points it in the right direction and adjusts focus and zoom on the lens. We have teachers who can make these simple technical adjustments without disrupting their train of thought, or their remarks. The students watch all this on a wide shot from the manned camera.

It will be evident by now that what I am suggesting is that any televised lecture or lesson presentation (probably 95 per cent of instructional TV as it is now being done) can be better presented by this simple method than by most of the TV techniques now employed. The cost of special TV studios, control rooms and special lighting is eliminated. The cost of operation is reduced, first in maintenance, in proportion to the reduction in complexity of equipment, and second, in reduction of the studio crew. The need for control room crew is eliminated. Since a lavolier microphone is used there will be no need to "ride gain" once an audio level is established. The cameraman can handle this as well.

A standard vidicon camera with viewfinder and proper controls for manual operation will cost around $4,000. A small monitor to attach to the camera, facing the teacher, will be another $300, plus $50 for installation. There will be a choice between equipping this camera with a zoom lens, or the proper equipment for smooth camera movement. Since not all floors are adequate nor do all classrooms provide sufficient space, the zoom lens is usually to be preferred. Add $400 for a zoom lens and $250 for tripod, head and simple dolly. If camera movement is desired, plan on two lenses, a one and a two-inch (others are very rarely used) at $100 each, and a good pedestal and head at $750. Ideally, of course, one should have the equipment for camera movement <u>and</u> the zoom lens; therewill be applications for both.

So the total investment could add up as follows:

Overhead TV camera and assembly	$4150
Viewfinder camera, zoom lens and tripod	4500
Audio system	1000
	$9650

Closed circuit wiring, amplifications, and classroom monitors will of course be extra. Figure $50 a classroom for wiring within a building with conduits to every room; $350 apiece for classroom monitors.

Since Overhead TV is essentially a new idea, there is no equipment as yet designed specifically for the purpose. Adaptation of industrial TV gear to copy stands, light stands, etc., is probably more expensive than the entire system would be if manufactured strictly for the purpose.

Further experiment and research on the effectiveness of ETV is needed. So far we can refer only to Miss Van Deman's half semester of experience in Music 31 at UCLA. In addition to her statement that she was able to give the final exam at midterm, she has this to say:

"Finding new ways with the Overhead TV to directly <u>see</u> what we <u>hear</u> has keenly focused students' attention on both the audial and intellectual aspects of basic music. Each individual is involved personally in learning basic performance skills and in basic music reading through an intimate view of the music score and chart being written and the chords and melodies being played. It may be the sharp accent on the visual and the personal that has made so much more musical experience possible in half a semester."

FIGURE 2

FIGURE 1

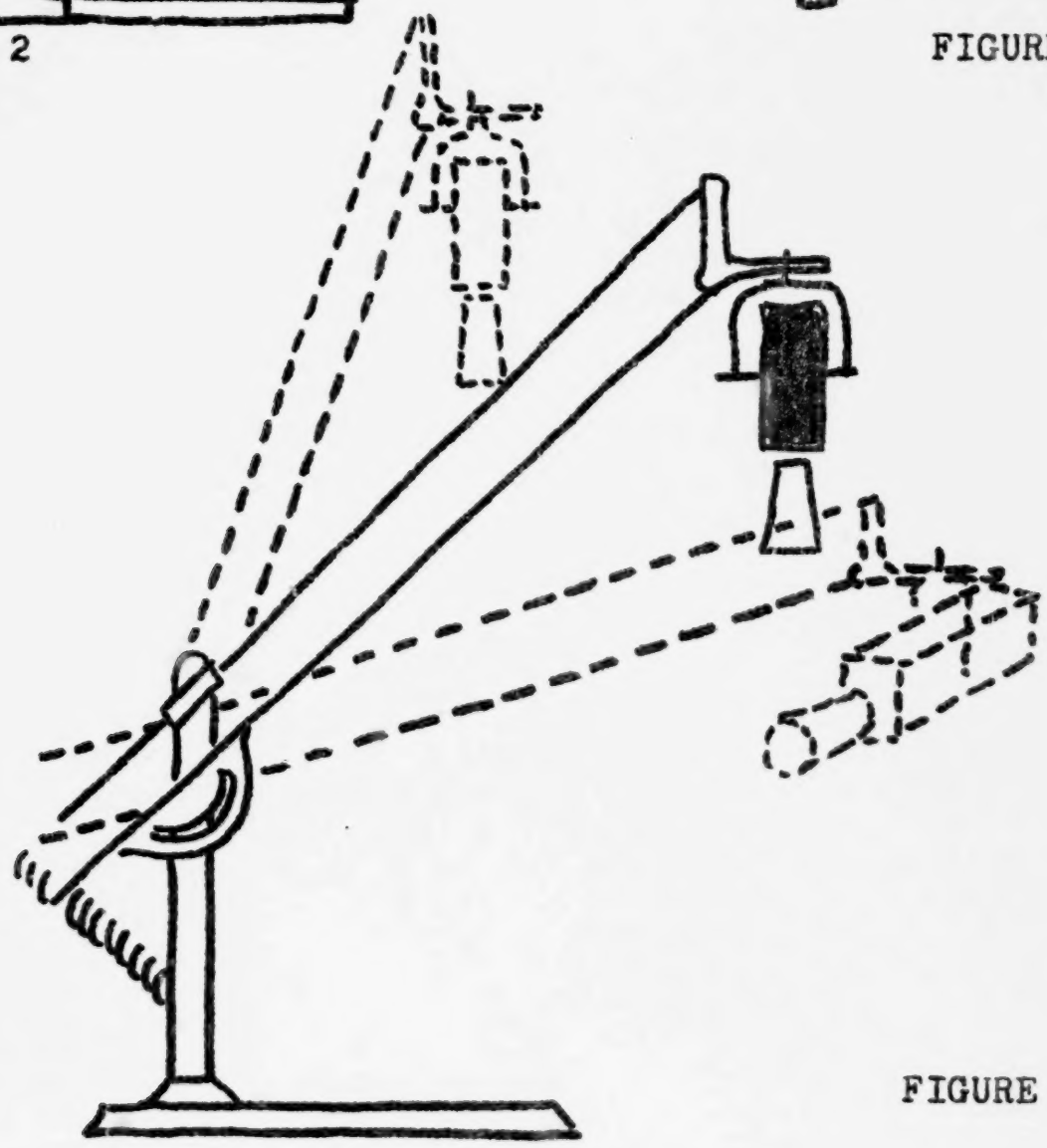

FIGURE 3